

FCC – OET White Spaces Testing

Shure Incorporated

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LEGENDARY
PERFORMANCE™

Shure Thanks the FCC

Shure Incorporated thanks and commends the FCC and OET staff for undertaking this difficult, but very important, open laboratory testing program.

This testing is critical as the FCC must prove White Spaces technology will protect incumbents from interference in both laboratory and field testing before rules are written to allow new portable unlicensed devices to occupy the TV bands.

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Unlicensed Device Testing

The Office of Engineering and Technology has been testing the second round of unlicensed device prototypes for the ability to sense wireless microphones in laboratory tests.

Shure has observed several days of the sensing tests – the laboratory engineering staff and the testing process have been very helpful and constructive.

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Unlicensed Device Testing

To date, the tests have focused on sensing static single microphone signals, as well as microphone signals in the presence of adjacent DTV signals.

Both analog and digital microphones have been used for the sensing tests.

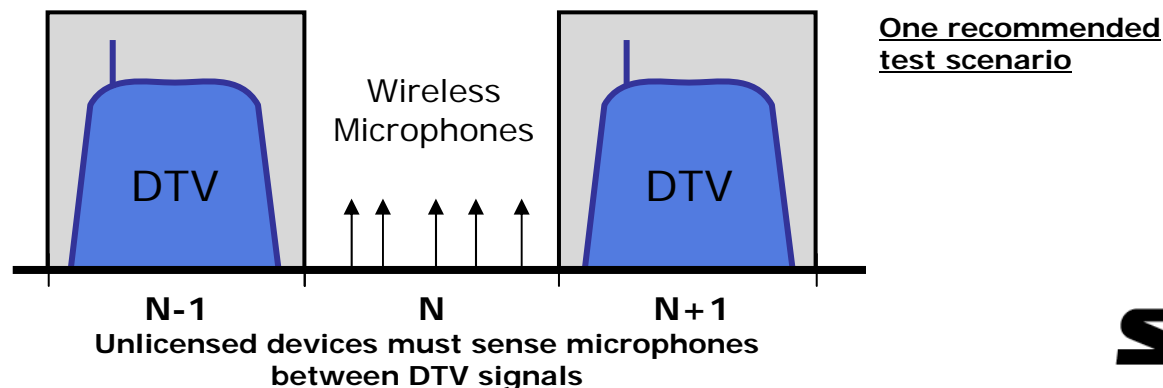
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Unlicensed Device Testing

In November of 2007, Shure filed a set of recommendations with the FCC to support the second round of unlicensed device testing.

Shure urged the FCC to examine the sensing performance when microphone signals are located in open TV channels adjacent to DTV signals.

This scenario is a very real occurrence in broadcasting. Unlicensed devices failed to detect microphones under these conditions in the first round of testing last year.



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Unlicensed Device Testing

To help put the FCC laboratory testing into context, create physical scenarios based on the signal levels being used for the sensing tests.

White Spaces Testing Scenarios

The microphone and DTV signals are currently being injected directly into the unlicensed device prototype antenna input via coaxial cables.

- Note the unlicensed device antenna is not being factored into the sensing performance during these tests

Using the FCC DTV (50,90) curves and existing DTV station information, the signal levels used for the sensing tests are converted to propagation distances.

White Spaces Testing Scenarios

Examine three FCC tests in which unlicensed device prototypes attempt to sense wireless microphones in the presence of adjacent DTV signals

Scenario 1: DTV Signal Level = -28dBm (moderately strong)

DTV: TV channel 43+45, -28dBm

Wireless Microphone: TV channel 44, -80dBm

Scenario 2: DTV Signal Level = -68dBm (average)

DTV: TV channel 43+45, -68dBm

Wireless Microphone: TV channel 44, -100dBm

Scenario 3: DTV Signal Level = -84dBm (low)

DTV: TV channel 43+45, -84dBm

Wireless Microphone: TV channel 44, -100dBm

White Spaces Testing Scenarios

F(50,90) curve for DTV

Choose a DTV:

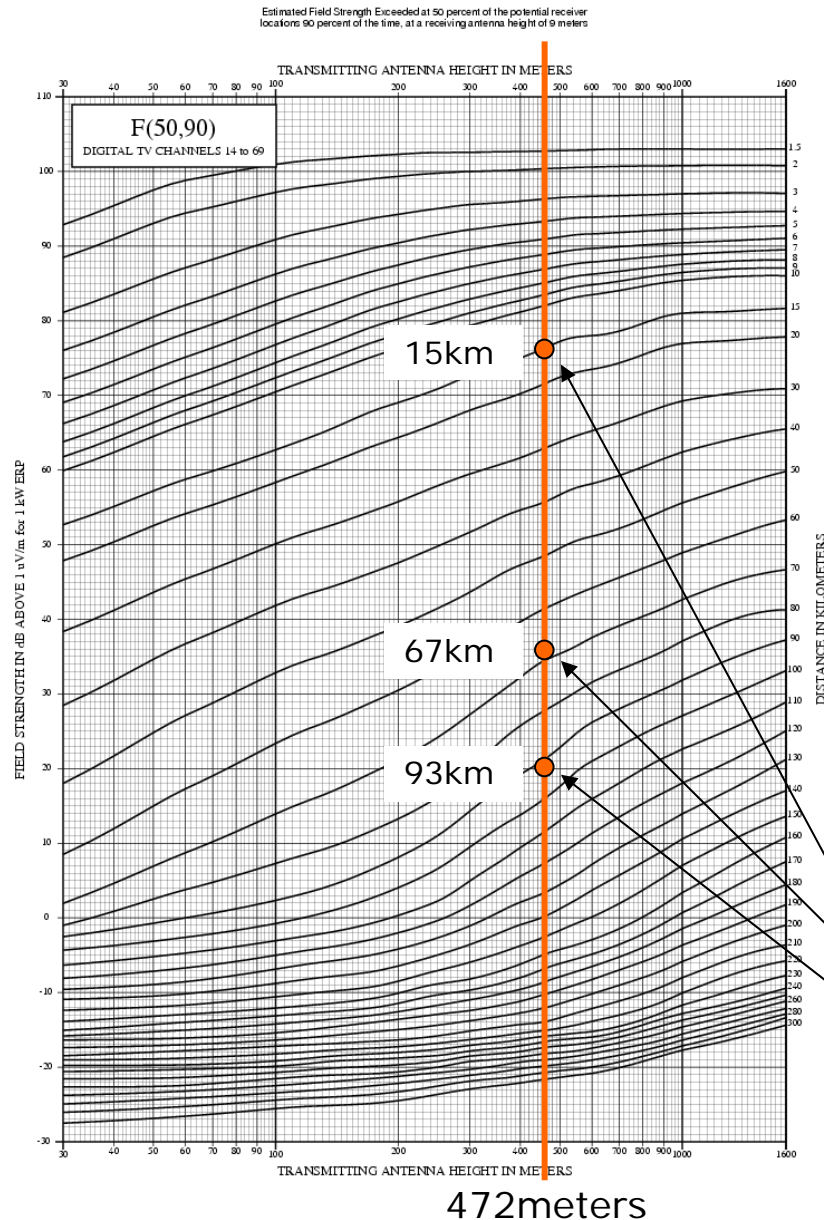
WSNS-DT

CH. 45

656-662MHz

467kW

472meters HAAT



Using a dipole antenna, convert the DTV test signals into field strength.

-28dBm = 103dBuV/m

-68dBm = 63dBuV/m

-84dBm = 47dBuV/m

Using WSNS-DT at 467kW, locate the DTV field strengths on the F(50,90) curve to get distance.

467kW = +27dBk
(normalize to 1kW)

103dBuV/m - 27dB = 76dBuV/m

63dBuV/m - 27dB = 36dBuV/m

47dBuV/m - 27dB = 20dBuV/m

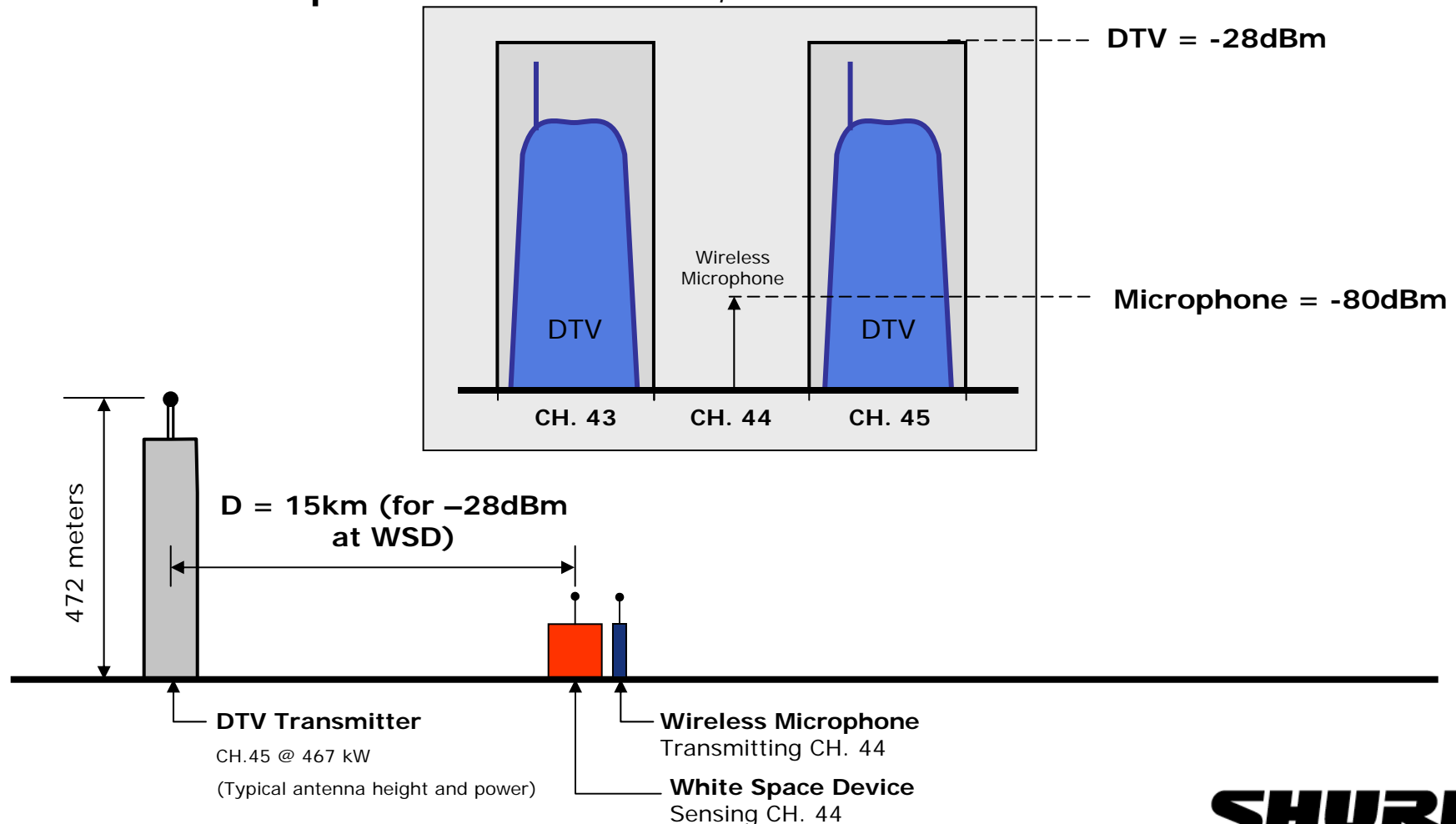
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White Spaces Testing Scenarios

Scenario 1: DTV Signal Level = -28dBm (moderately strong)

DTV: TV channel 43+45, -28dBm

Wireless Microphone: TV channel 44, -80dBm



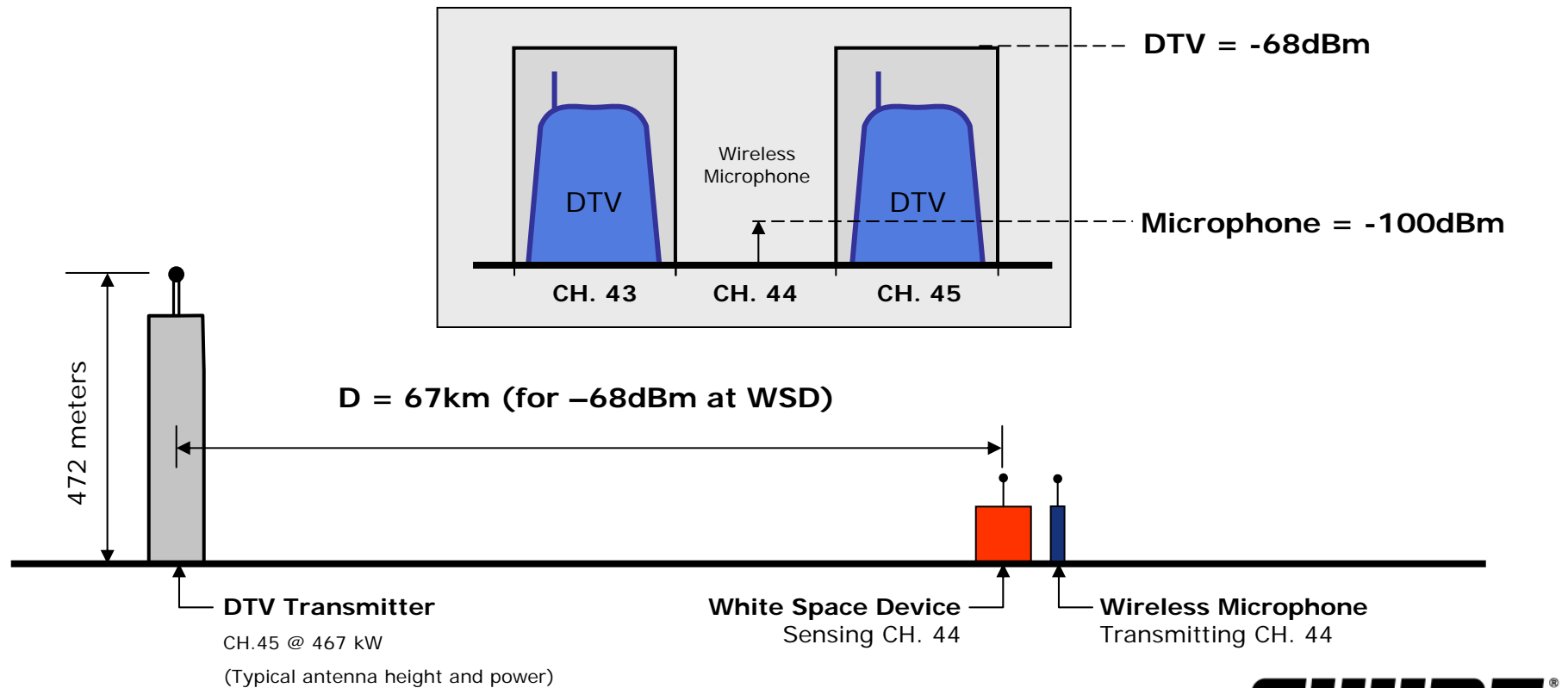
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White Spaces Testing Scenarios

Scenario 2: DTV Signal Level = -68dBm (average)

DTV: TV channel 43+45, -68dBm

Wireless Microphone: TV channel 44, -100dBm



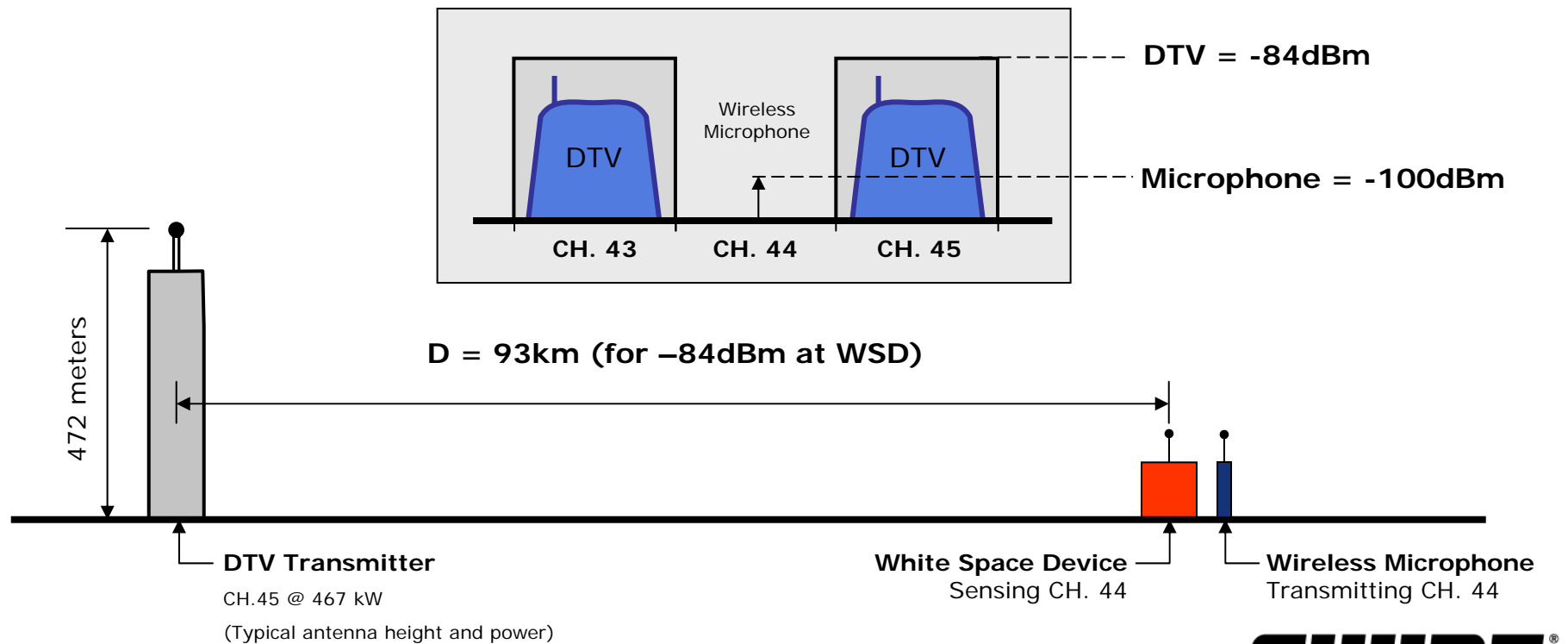
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White Spaces Testing Scenarios

Scenario 3: DTV Signal Level = -84dBm (low)

DTV: TV channel 43+45, -84dBm

Wireless Microphone: TV channel 44, -100dBm



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Testing implications

These laboratory tests do not yet take into account real-world factors such as signal fading and the sub-optimal antenna performance of the unlicensed device.

The results of the OET adjacent channel DTV tests need to be carefully evaluated against the ability of portable unlicensed devices to detect wireless microphones using sensing technology.

White Spaces Testing

Testing implications

If portable unlicensed devices cannot be proven to reliably detect wireless microphones operating adjacent to DTV channels, then portable unlicensed devices should be prohibited from operating in those TV channels.

Continued White Spaces Testing

Further laboratory testing

Sensing tests using DTV signal strength of -20dBm should be conducted

- These levels exist in urban environments where wireless microphones are constantly used in broadcasting

Unlicensed device transmission tests should be conducted with co-channel transmission into wireless microphones

- Need to test the cognitive ability against the proposed DFS model to stop unlicensed transmissions after microphones are detected

White Spaces Field Testing

Shure stands ready to support real-world field testing of unlicensed devices and wireless microphones at the request of the FCC

Venue options include:

- NBA Basketball Finals (April/May)
- NCAA Basketball Tournament (March / April)
- MLB Baseball (April/May/June)

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